CHAPTER 2

COLOR

Overview

Introduction

To use color effectively, you must know what color is, how to organize color, and how to use color advantageously. Light contains all of the colors we see. Therefore, it is also necessary to understand some of the characteristics of light.

Objectives

The material in this chapter enables you to do the following:

- Differentiate among four different color theories and applications.
- Select a color scheme for high key achromatic illustrations.
- Assemble three types of palettes.
- Create effective color combinations.
- Describe the differences among several color schemes.
- Prepare color masters for subsequent printing.
- Recognize the difference between process color and computer-generated color.

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Overview, Continued

Acronyms

The following table contains a list of acronyms that you must know to understand the material in this chapter.

Acronym	Meaning
bit	Binary Digit
CCD	Charge-Coupled Device
CEPS	Color Electronic Prepress System
CYMK	Cyan, Yellow, Magenta, and Black
dpi	Dots Per Inch
MAC	Macintosh computer or clone
nm	Nanometer
PC	Personal Computer (IBM or IBM clone)
Pixel	Picture Element
PMT	Photomultiplier Tube
RAM	Random Access Memory
VGA	Video Graphics Array
WYSIWYG	What You See Is What You Get

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Overview, Continued

In this chapter This chapter covers the following topics:

Light

Introduction

Without light there would be no vision or color. Light reflected from objects around us makes things visible.

Light

Light is a form of electromagnetic radiant energy visible to the human eye. The visual spectrum, what we see, is only a small part of the entire electromagnetic spectrum.

Figure 2-1 shows the range of the electromagnetic spectrum.

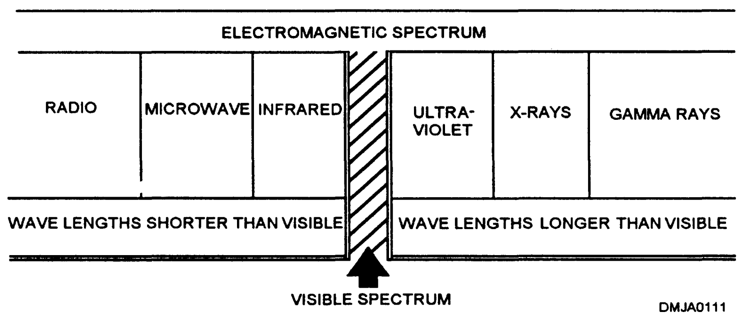

Figure 2-1.—The position of visible light in the electromagnetic spectrum.

White light refracted through a prism reveals the colors that comprise the visible spectrum.

Figure 2-2 shows visible light as refracted through a prism.

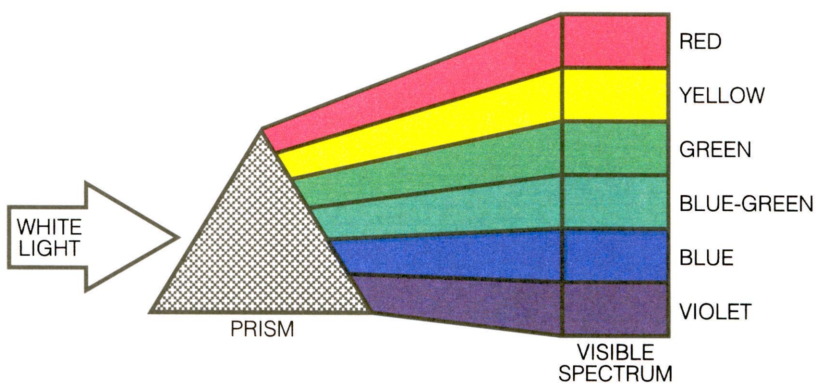

Figure 2-2.—The refraction of light by a prism.

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Characteristics of light

No one completely understands the nature of light. However, two theories of light are used to explain light characteristics. The two theories of light are referred to as the *quantum theory* and the *wave motion theory*.

QUANTUM THEORY: The quantum theory of light applies to X-ray, radiation, and photoelectricity. This theory states that light is a steady stream of high-speed particles and that all light sources send out a stream of these particles. Each particle of light (quantum) is referred to as a *photon*.

WAVE MOTION THEORY: The wave motion theory of light involves reflection, absorption, transmission, and polarization of light.

Wave motion theory

In the wave motion theory of light, light, wavelength, speed, and frequency are important but interrelated characteristics. The wave motion theory is the theory that affects Illustrator Draftsman the most.

LIGHT: Light stimulates the perception of sight. White light is made of equal intensities of all wavelengths within the visible spectrum. What we see as color is light of a particular wavelength.

WAVELENGTH: Wavelength is the chief determinant of perceived color. A wavelength is defined as the distance from the crest of one wave to the crest of the next wave. Wavelengths are measured in nanometers (nm) which are equal to one millionth of a millimeter. Light travels in a straight line, and when it encounters an object or enters a new medium, say water, it may be reflected, absorbed, or transmitted.

SPEED: The speed of light is constant until it passes through a new medium, such as water, air, or glass. The speed of light is the product of wavelength multiplied by the frequency. Dividing the frequency by the (constant) speed of light results in approximate wavelength.

FREQUENCY: Frequency is the number of wavelengths passing a given point in 1 second.

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Wave motion theory (Continued)

Figure 2-3 shows the relationship between wavelength and frequency.

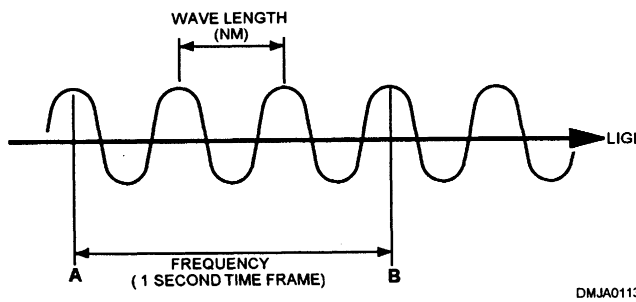

Figure 2-3.—The relationship of wavelength to frequency.

Reflection

Reflection occurs when light that strikes an object bounces off its surface. When a surface is smooth and polished, the reflection is orderly, or specular. Specular light reflects at the same angle to the surface as the incoming light. When a surface is irregular, light reflects irregularly and diffuses reflecting light in different directions. Practically all surfaces reflect both specular and diffused light.

Figure 2-4 illustrates specular and diffused light reflection.

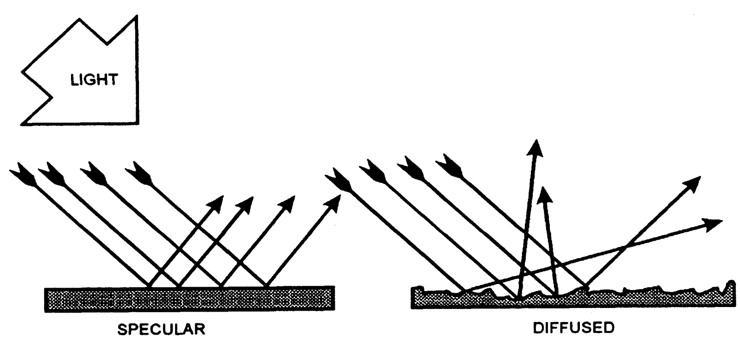

Figure 2-4.—Specular and diffused light reflections.

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Absorption

Absorption occurs when light strikes a medium and the light neither reflects from nor passes through the medium. The surface of the medium will, to some extent, both reflect and absorb light. How an object absorbs light determines the color of the object. Neutral colors, such as white, black, and various tones or values of grey absorb almost equal proportions of the colors of light. White is highly reflective. Black, no matter how much light falls on it, can never be recorded on film except by contrast.

Transmission

Light rays pass through some media they encounter. When objects are clearly seen through the medium, the medium is said to be transparent. Transparent media transmit light rays in regular or uniform patterns. When the medium transmits light but breaks up the order of the pattern and sends the transmitted rays to different directions, the medium is referred to as translucent. An opaque medium does not allow light to pass through. Refraction is a form of transmission. Refraction is the change in direction that occurs when light rays pass from one transparent substance into another substance of different density.

Figure 2-5 shows the effect of different media on light rays.

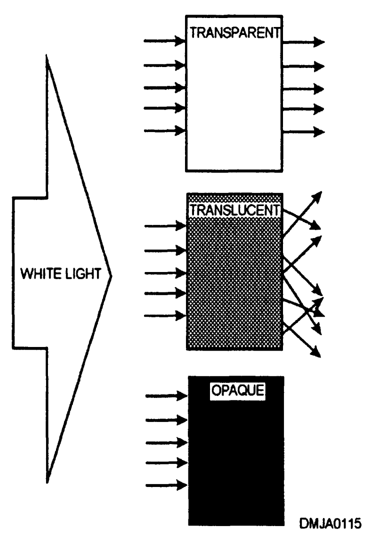

Figure 2-5.—The effect of different densities on light rays.

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Light, Continued

Polarization

Polarized light vibrates in only one direction. Ordinarily, light rays vibrate in all directions at right angles to their direction of travel. When light waves strike a series of parallel microscopic slots, all the light that passes through vibrate in one direction. Filters that polarize light have practical use in photography and in simulating motion on overhead projecturals. Specular light reflected from nonmetallic surfaces at any angle between 32° and 37°, is polarized in such a manner that the light rays vibrate in a direction parallel to the reflecting surface. Light reflected in this manner is said to be plane polarized and is seen as glare.

Figure 2-6 shows plane polarization or the characteristics of glare.

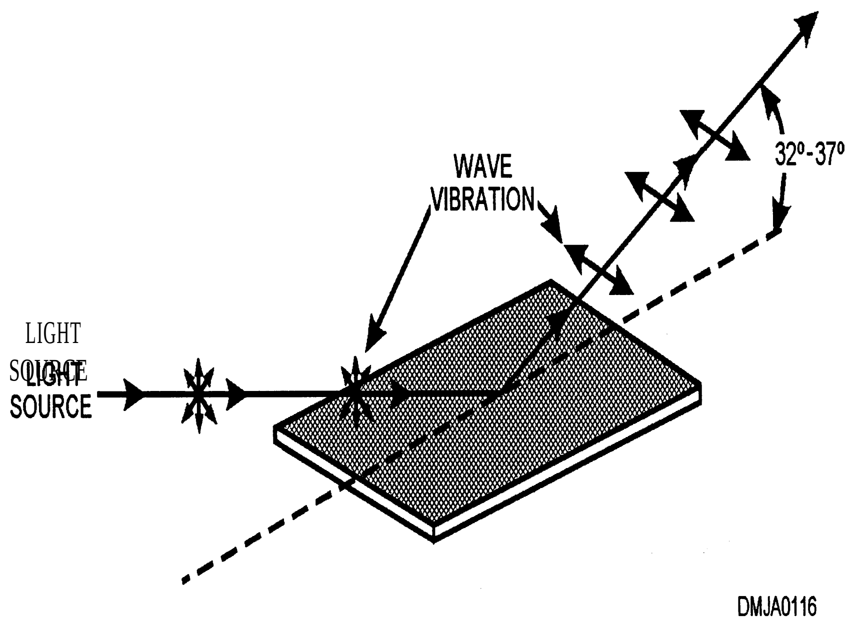

Figure 2-6.—Plane polarization or glare.

Additive Theory of Color

Introduction

Photography, computer monitors, and television use light to project the colors of the visual spectrum. This technology uses the additive theory of color.

The additive theory of color

The additive theory of color theorizes that white light contains all colors in the visual spectrum. The primary colors of the additive theory of color are red, blue, and green. These colors are called primaries because they cannot be produced by combining any other color. Combinations of the primary colors produce other colors. A combination of the three spectral (additive) primaries produces white light.

Figure 2-7 shows the spectral primaries of the additive theory of color.

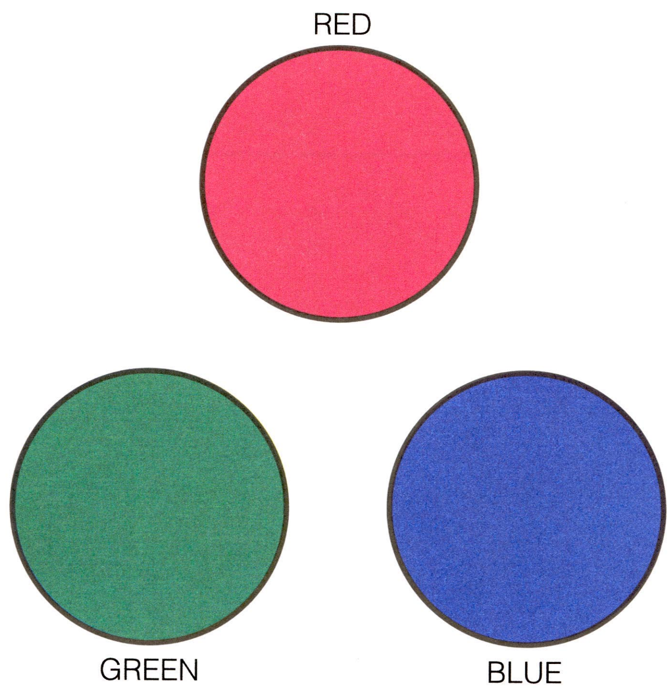

Figure 2-7.—Spectral primaries of the additive theory of color.